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# Critical Trends Assessment Program

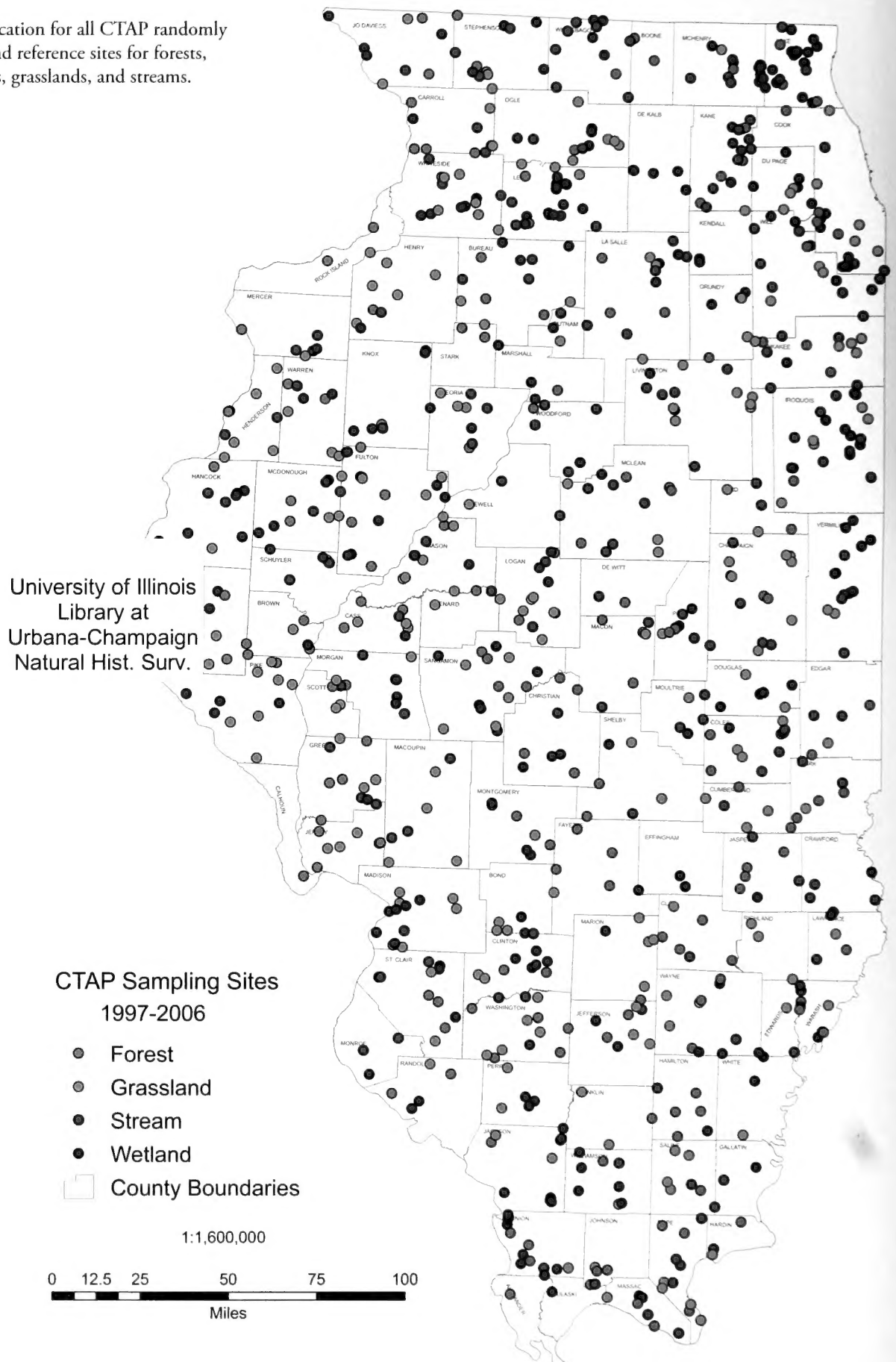
## Keeping an Eye on Illinois Habitats



ILLINOIS  
NATURAL  
HISTORY  
SURVEY



Figure 1. Location for all CTAP randomly selected and reference sites for forests, wetlands, grasslands, and streams.







CTAP botanists collecting data in an Illinois wetland.

**I**llinois is a landscape in transition. The *Changing Illinois Environment: Critical Trends*, a state-of-the-environment report published in 1994 by the Illinois Department of Energy and Natural Resources (now the Department of Natural Resources) concluded that habitats in Illinois were deteriorating as a result of habitat fragmentation and biotic/abiotic stressors. This report recommended collecting statewide data on both the current conditions and future trends in Illinois habitats. Since 1997 the scientists of the Critical Trends Assessment Program (CTAP, <http://ctap.inhs.uiuc.edu/>) have been undertaking this task.

CTAP is a long-term habitat monitoring program across the state of Illinois. It is sponsored by the Illinois Department of Natural Resources (<http://dnr.state.il.us/>) and housed at the Illinois Natural History Survey (<http://www.inhs.uiuc.edu/>). The main goal of CTAP is to gather baseline data on the current conditions of forests, wetlands, grasslands, and streams and to determine how these habitats are changing. This information supports efforts to preserve, restore, and manage Illinois forests, wetlands, grasslands, and streams.

CTAP has been collecting detailed biological data in 600 randomly selected sites (150 randomly selected

sites per habitat [30 sites per year rotating on a five-year cycle])(Fig. 1) from across the state on both public and private lands (Fig. 2). Data on plants, birds, and terrestrial insects have been collected in forests, wetlands, and grasslands (Table 1), while for streams aquatic insect data are collected (see CTAP Web page for sampling protocols).

Although CTAP has accumulated an incredible amount of information during its first five-year cycle (1997–2001) and has detected several trends (see CTAP Web page for other annual reports), our sampling did not generate enough information on high-quality (reference) sites to evaluate and put the conditions of our randomly selected sites into perspective. Therefore, over the past several years, reference sites in all habitats were sampled to allow us to better understand how the condition of “random” or “average” habitats compare to reference sites.

In this report we provide the first overall comparison between these reference sites and randomly selected sites of our first five-year cycle (1997–2001). It should be noted that the term “reference” as used in this report indicates the highest quality habitat (site) for to each specific CTAP organism. In the case of plants and

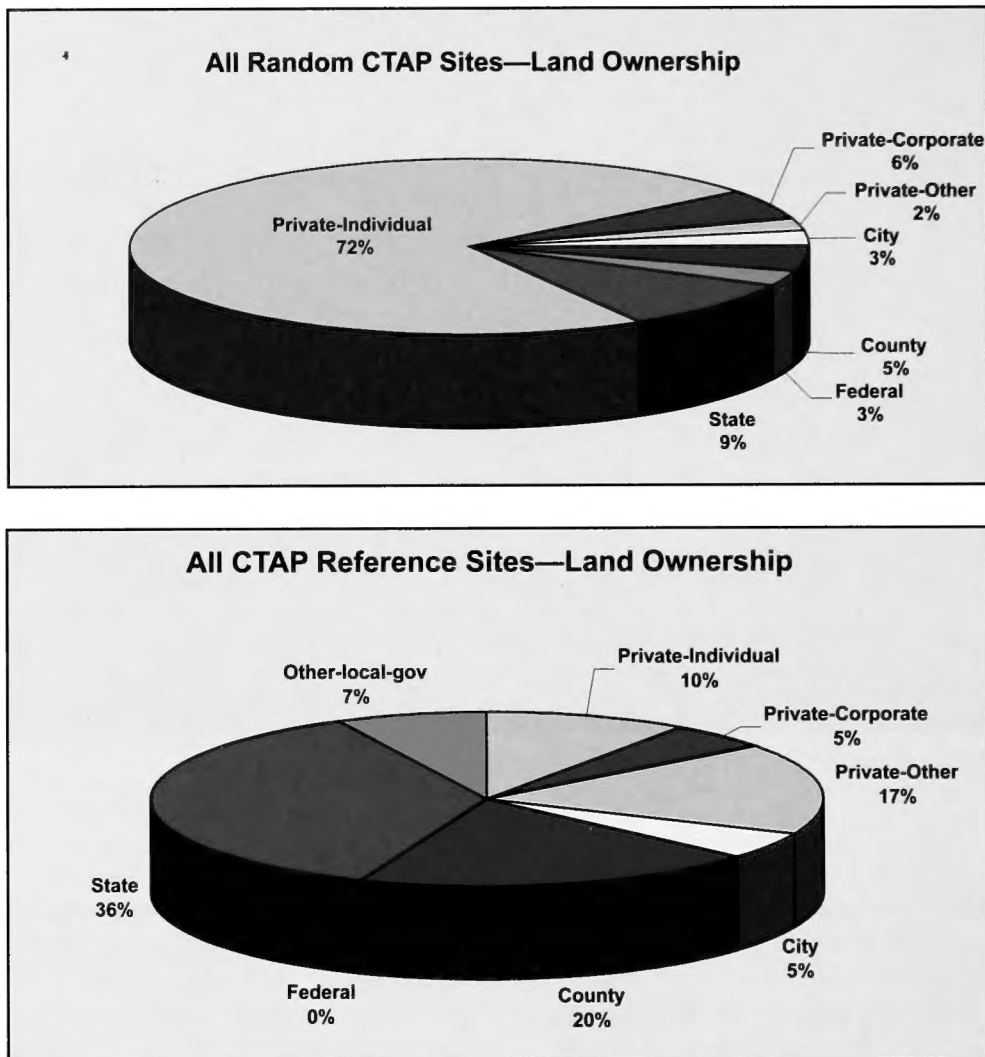


Figure 2. The proportion of land ownership on CTAP random and reference sites, illustrates that the majority of the randomly selected site (72%) are owned by private landowners, whereas only 10% of the reference sites are privately owned.

insects, this refers to sites where the vegetation is in a pristine or least-disturbed condition (often limited to Illinois Nature Preserves or other protected high-quality natural areas). For birds, this refers to large and unfragmented tracts of forests, wetlands, and grasslands which are the only ones capable of supporting breeding and habitat dependent bird species (i.e., forests >70, wetlands >13, and grasslands >80 hectares). Reference streams are those that have relatively clean waters, and just as importantly, those that remain in their natural condition with meanders, deep and shallow pools, with intervening riffles providing a variety of habitats for fish and aquatic invertebrates.

In the first section we present plant and bird data from the randomly selected and reference sites for forests, wetlands, and grasslands.

Terrestrial insect data are still being processed; therefore, no information is presented in this report. Aquatic insect data are presented for randomly selected sites statewide and reference sites in the Grand Prairie Region (the state's largest region). The final section of this report will provide a summary of our findings and future directions of CTAP.

Table 1. Types of natural communities sampled by CTAP botanists in each major terrestrial habitat.

Forest	Wetlands	Grasslands
(May–June)	(July)	(August)
Random Sites		
<ul style="list-style-type: none"> <li>• dry upland forest</li> <li>• dry-mesic upland forest</li> <li>• dry-mesic sand forest</li> <li>• mesic (moist) upland forest</li> <li>• mesic floodplain forest</li> <li>• wet-mesic floodplain forest</li> <li>• wet floodplain forest</li> <li>• tree plantation</li> </ul>	<ul style="list-style-type: none"> <li>• wet pastureland (abandoned, lightly grazed)</li> <li>• wet hayfield</li> <li>• wet old field</li> <li>• wet utility strip/rights-of-way</li> <li>• marsh</li> <li>• sedge meadow</li> <li>• seep</li> <li>• shrub swamp</li> <li>• wet prairie</li> <li>• restoration (wet prairie, wetland)</li> <li>• pond edges</li> </ul>	<ul style="list-style-type: none"> <li>• pastureland (abandoned, lightly grazed)</li> <li>• hayfield</li> <li>• old field/sandy old field</li> <li>• utility strips/rights-of-way</li> <li>• prairie restoration</li> <li>• wildlife planting, CRP</li> <li>• dry-mesic prairie</li> <li>• dry-mesic sand prairie</li> <li>• mesic prairie</li> </ul>
Reference Sites		
<ul style="list-style-type: none"> <li>• dry-mesic upland forest</li> <li>• mesic upland forest</li> <li>• wet-mesic floodplain forest</li> </ul>	<ul style="list-style-type: none"> <li>• marsh</li> <li>• seep</li> <li>• graminoid fen</li> </ul>	<ul style="list-style-type: none"> <li>• dry-mesic prairie</li> <li>• mesic prairie</li> </ul>



Since it is not feasible to measure all biological components of a habitat, CTAP focuses on representative groups (plants, birds, and insects) to measure change. In this report we present the following information for each main group:

- **Plants:** percent cover was estimated for ground-layer species; Species Richness (SR), Floristic Quality Index (FQI), and Coefficient of Conservatism (CC) were calculated (Table 2).
- **Birds:** species richness (SR) is simply the number of species detected during the sampling period for

each site, number of habitat dependent species [(HD), species that need either forest, wetland, or grassland habitat in which to nest and live], and area dependent species [(AD), species that must have habitats of a minimum size and are sensitive to habitat fragmentation]. Table 3 shows numbers of HD and AD per habitat used by CTAP.

- **Aquatic insects–EPT richness** — the number of species of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) in a sample. EPT species are relatively intolerant of pollution, and the EPT richness is one of the most efficient ways to measure stream health.

Table 2. CTAP indicators of terrestrial habitat health.

Species Richness (SR)	Number of different species in a given area.
Coefficient of Conservatism (CC)	Scores assigned to an area's plants that reflect the plants' tendencies to be found in undisturbed natural areas; in other words, how weedy are the plants?
Floristic Quality Index (FQI)	Measures the conservation value and habitat quality of plants in a given area are by combining both CC and SR.

Table 3. Number of Habitat Dependent and Area Dependent bird species used by CTAP. Habitat Dependent (HD) describes bird species, that need a specific habitat in which to live and nest. Area Dependent (AD) describes a bird species that needs a minimum area before utilizing a site to live or to nest in.

Habitat	Habitat Dependent	Area Dependent
Forests	65	47
Wetlands	49	
Grasslands	21	11



Redbud and zebra swallowtail butterflies are most common in the southern forests of Illinois.



**I**llinois forests have been a vast resource for generations of people and provided homes for wildlife throughout the state's history. In the early 1800s Illinois forests totaled approximately 15.3 million acres, occurring in large, contiguous tracts throughout the southern third and western sections of the state, while remaining restricted to ravines or stream valleys in the central region (Fig. 3). Starting in the early 1820s with the influx of European settlers, wood resources and agricultural land were in high demand, resulting in extensive clearing of forests. By 1870 only 6 million acres of the original 15.3 million forest acres were intact, and by 1923 only 3 million acres remained.

Since that time, reforestation programs and land use changes have helped to restore Illinois forests to their current total of 4.3 million acres, most of which are considered to be in an intermediate stage of growth. Of the original forests in Illinois, only 24,990 acres are known to remain in high-quality (little disturbed) condition. The once large and contiguous tracts have become very fragmented, with 63% of all forested parcels now less than 100 acres in size.

To characterize and monitor Illinois' forests, CTAP randomly selected 133 (140 in the case of birds\*) forests to survey their plants and birds. These forests, randomly located throughout the state, provide a representative selection of forest conditions in Illinois, ranging from those that have been recently logged or storm damaged to nature preserves that have remained relatively undisturbed since early settlement times. In addition, 20 high-quality forests (12 dry mesic uplands and 8 wet mesic floodplains) were surveyed for plants. In the case of birds, eight large, unfragmented forests were used as reference sites for comparison with the randomly selected sites.

With regard to plants, the randomly selected sites had slightly more native and introduced species than reference sites (Fig. 4 and 5; Table 3), while the reference sites had slightly greater numbers of sensitive plant species than randomly selected sites (Fig. 6; Table 3). The most likely explanation for these results is the degree of disturbance and the age of, the randomly selected sites compared to the reference sites. Most of the randomly selected sites have experienced considerable human disturbances making them relatively young forests, allowing for more pioneer or early successional plants to be found in them, thereby boosting overall diversity. Generally, these data suggest that the plant communities in forests are not radically different between random and reference sites, as compared to

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\* CTAP biologists visit the same forest for plant, insect, and bird data. In some cases due to unforeseeable circumstances at a site, only one kind of datum was collected. This is the reason for the discrepancy between the number of plants and bird sites.

## Forests



Dutchman's breeches



cypress katydid



Barred Owl

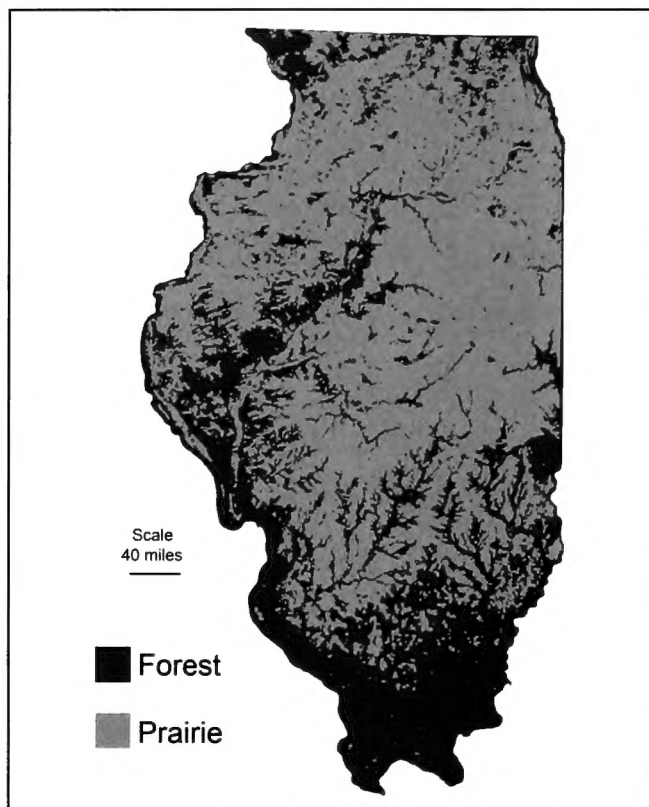


Figure 3. Forest and prairie habitat distribution in Illinois in the 1820s (R.C. Anderson, 1970).

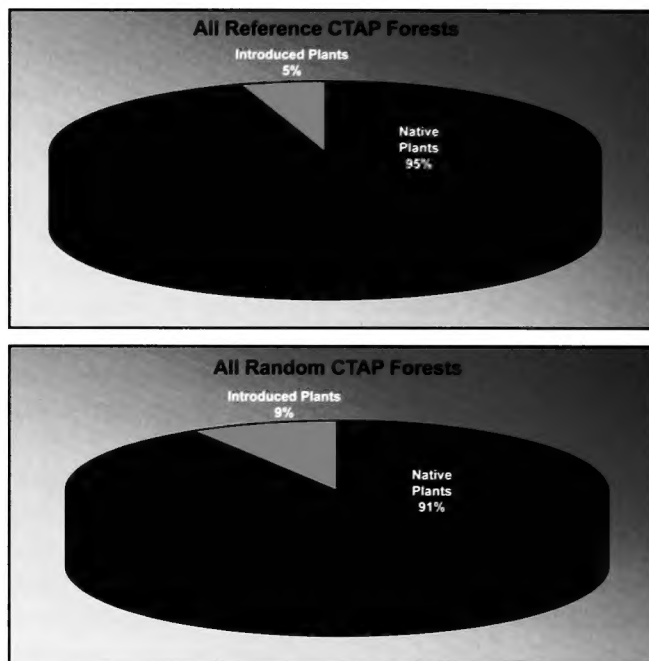


Figure 4. Proportion of native and introduced plant species cover in the ground layer of forest sites.

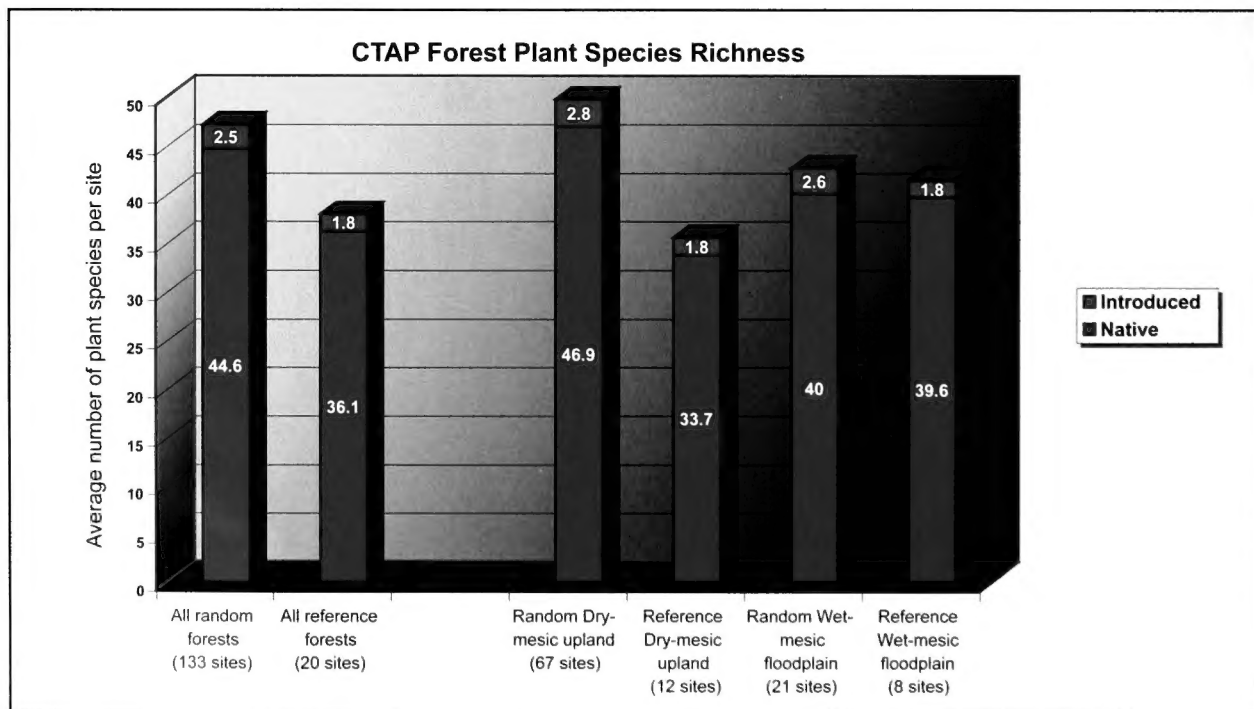


Figure 5. Average number of plant species per forest site in random and reference site community types.



Typical reference (**A**) and randomly chosen (**B**) forest monitored by CTAP biologists. Forests are vegetated areas dominated by trees for over 80% or more of their area. For this report CTAP sampled two different kinds of forests, upland dry-mesic and floodplain (or bottomland) wet-mesic forests. Upland forests do not normally flood, and they typically have layers of vegetation consisting of a sub-canopy of younger trees and shrubs below the upper canopy (overstory). The herbaceous (or ground) layer of an upland forest can include sedges, grasses, forbs, and mosses. In the ground layer, “spring ephemeral” flowers bloom before all other plants, allowing them to grow before the trees leaf out and block sunlight.

Dry-mesic forests are the most common forest type in Illinois. Floodplain forests occur along streams and rivers, and because they periodically flood, excess water limits the types of trees and herbs that can grow in them. Wet-mesic floodplain forests are the most common floodplain forest type in Illinois. Compared to upland forests, plant diversity is high in the overstory (tree canopy), but lower in the ground layer. **A** shows a high-quality dry-mesic upland forest. **B** shows an upland dry mesic forest randomly selected by CTAP, with a dense understory and the presence of invasive, exotic plants such as multiflora rose.

other habitats (see “Wetlands” and “Grasslands” sections). In the case of birds, reference sites show greater species diversity than randomly selected sites (Figs. 7 and 8). In addition, as patch size increases more bird species are found, including habitat and area dependent species. Both of these results are not surprising since it has been documented that large unfragmented forest sites will promote greater bird diversity.



Trillium can carpet a high quality, reference forest floor in the spring.

Table 4. Total number of CTAP forest sites where sensitive plant species, threatened and endangered plant species, and introduced plant species were sampled. Also included is the number of sites where native and introduced species were dominant<sup>1</sup> in the ground layer.

CTAP random forest sites			CTAP reference forest sites		
Criteria	# sites	% of total	Criteria	# sites	% of total
at least one sensitive species <sup>2</sup>	75	56.4%	at least one sensitive species	13	65.0%
at least one T & E species	1	0.8%	at least one T & E species	2	10.0%
at least one introduced species	110	82.7%	at least one introduced species	16	80.0%
Ground layer			Ground layer		
dominated by native species	118	88.8%	dominated by native species	19	95.0%
dominated by introduced species	15	11.3%	dominated by introduced species	1	5.0%

<sup>1</sup>Dominance was determined by the species with the highest calculated importance value at each site.

<sup>2</sup>Sensitive species are plant species that are highly sensitive to human habitat disturbance. They have a Coefficient of Conservatism value of >7.

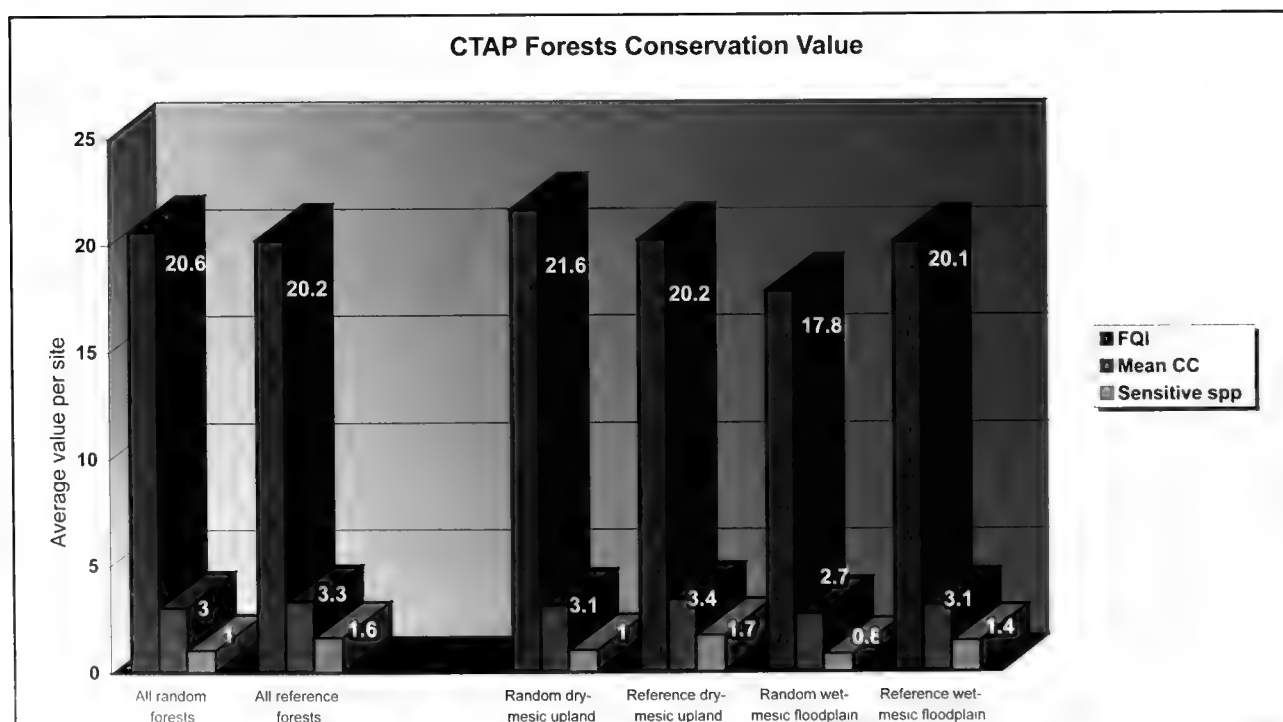
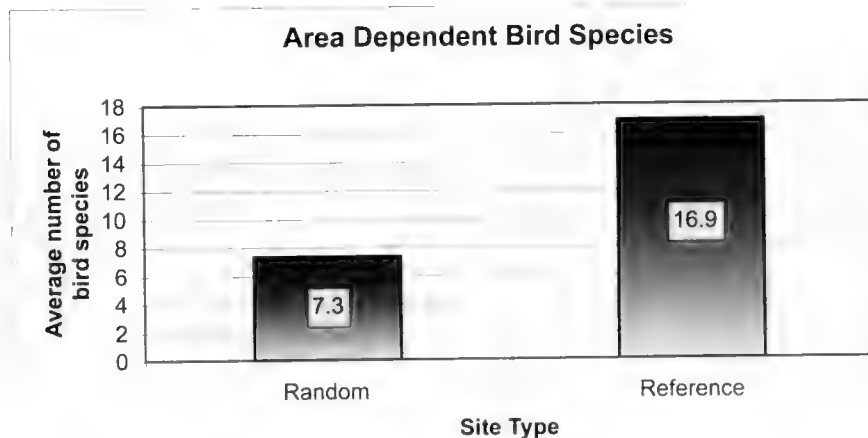
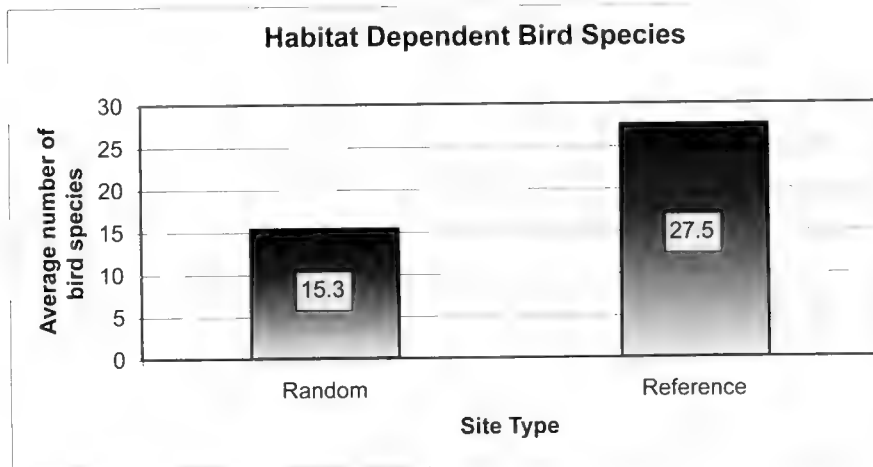
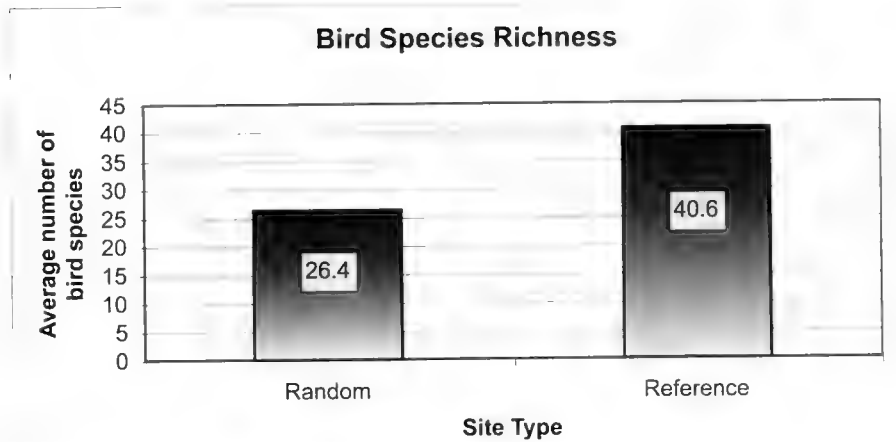


Figure 6. Average Floristic Quality Index, Mean Coefficient of Conservatism, and number of sensitive plant species per forest site in CTAP random and reference sites.



Figures 7. The values shown represent state average number of bird species for both random and reference forest sites. Forest reference sites, due to their generally larger sizes and better quality habitat, are expected to contain higher numbers of bird species, including more Habitat Dependent species, and more Area Dependent species than the randomly selected forest sites. These differences are found for all three of the categories (Species Richness, Habitat Dependent, and Area Dependent).



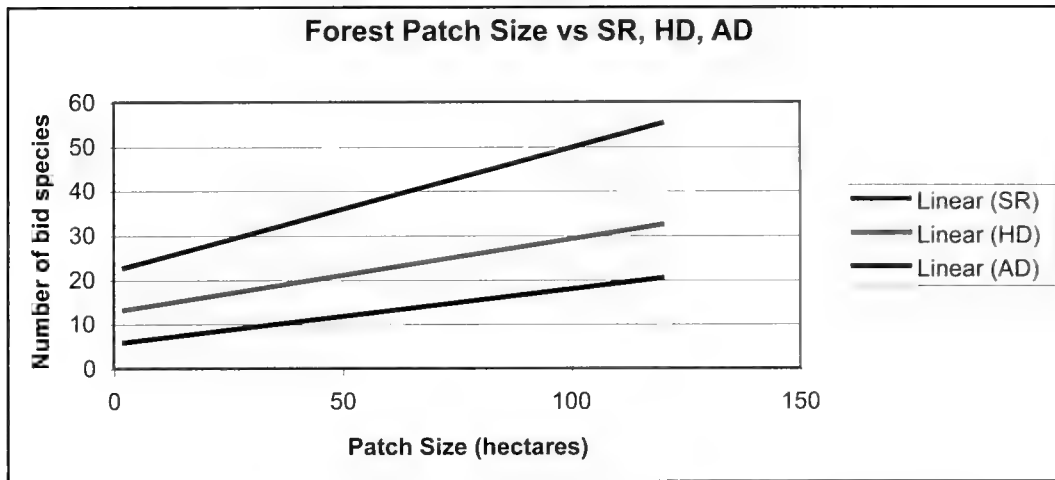


Figure 8. Patch size is the cumulative area surrounding all bird census points within a site. The total patch size for each site is dependent on the total number of point counts, which in turn depend on the size of the forest. In general, as patch size increases so does the number of Species Richness (SR), Habitat Dependent (HD), and Area Dependent (AD) species.



The Worm-eating Warbler breeds in large deciduous woodlands, mostly in southern Illinois.

**W**etlands are just that—wet! These ecosystems depend on constant or recurrent, shallow inundation or saturation by surface or ground water. As such, many unique plants and animals that are adapted to wet conditions make their homes in Illinois wetlands. Besides plant and wildlife habitat, wetlands provide environmental functions that include flood control, erosion reduction, and groundwater recharge.

Historically, wetlands once covered more than 8 million acres in Illinois or 23% of the landscape. As a result of human modification of our landscape, an estimated 90% of these wetlands have been destroyed. Wetlands now occupy about 1.25 million acres or 3.5% of Illinois. Besides outright destruction and drainage, many of our remaining wetlands have been degraded by pollution, excess silt, and invasion by non-native plant species. As a result, only about 6,000 acres of wetland are considered of high biological or ecological quality.

To characterize and monitor Illinois' wetlands, CTAP randomly selected 137 (139 in the case of birds\*) wetlands across the state identified by the Illinois Wetlands Inventory database. Since the term wetland covers a broad range of plant community types, CTAP surveyed sites dominated by herbaceous vegetation with less than 50% woody plant cover. These include open plant communities like marshes and wet prairies, but not bottomland forests or cypress swamps. In addition, 10 high-quality marshes were surveyed for plants and 23 large wetlands were surveyed for birds to be used as reference sites to compare to randomly selected sites. In the case of birds, 45 additional randomly selected wetlands were also monitored. These additional wetlands were selected to increase sample size.

Overall, the reference sites had greater plant and bird diversity than the randomly selected sites. In the case of plants, reference sites had twice the number of native species (Figs. 9 and 10) and almost three times higher FQI values compared to the randomly selected sites (Fig. 11). In addition these reference sites had greater numbers of sensitive plants than randomly selected sites (Fig. 11; Table 5). The most likely explanation for these results is the degree of past and current disturbances (i.e., excess siltation, draining, plowing, grazing, pollution) associated with the randomly selected sites. Most of the randomly selected sites have experienced severe human disturbance to their natural hydrological regime (i.e., too much or too little water) to which the original flora and fauna of Illinois are adapted, resulting in the invasion by introduced species, such as

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\* CTAP biologists visit the same wetland for plant, insect, and bird data. In some cases due to unforeseeable circumstances at a site, only one kind of datum was collected. This is the reason for the discrepancy between the numbers of plants and bird sites.

## Wetlands



copper iris



Least Bittern



skunk cabbage



Typical reference **A** and randomly chosen **B** wetlands monitored by CTAP biologists. Wetlands are vegetated areas where water is at or near the soil's surface for at least a few months of every year, allowing only aquatic or hydrophytic (water-loving) vegetation to grow in them. Wetlands are easily identified year-round by their hydric (very poorly drained) soils. For this report CTAP sampled a type of wetland (marsh) that has water

near or above the soil surface for most of the year. Marshes are dominated by rushes, sedges, grasses, cattails, and other herbaceous plants. **A** shows a high-quality marsh with a high diversity of native species. **B** shows a randomly selected CTAP marsh where invasive narrow-leaf cattail and reed canary grass have invaded and become the dominant plants.

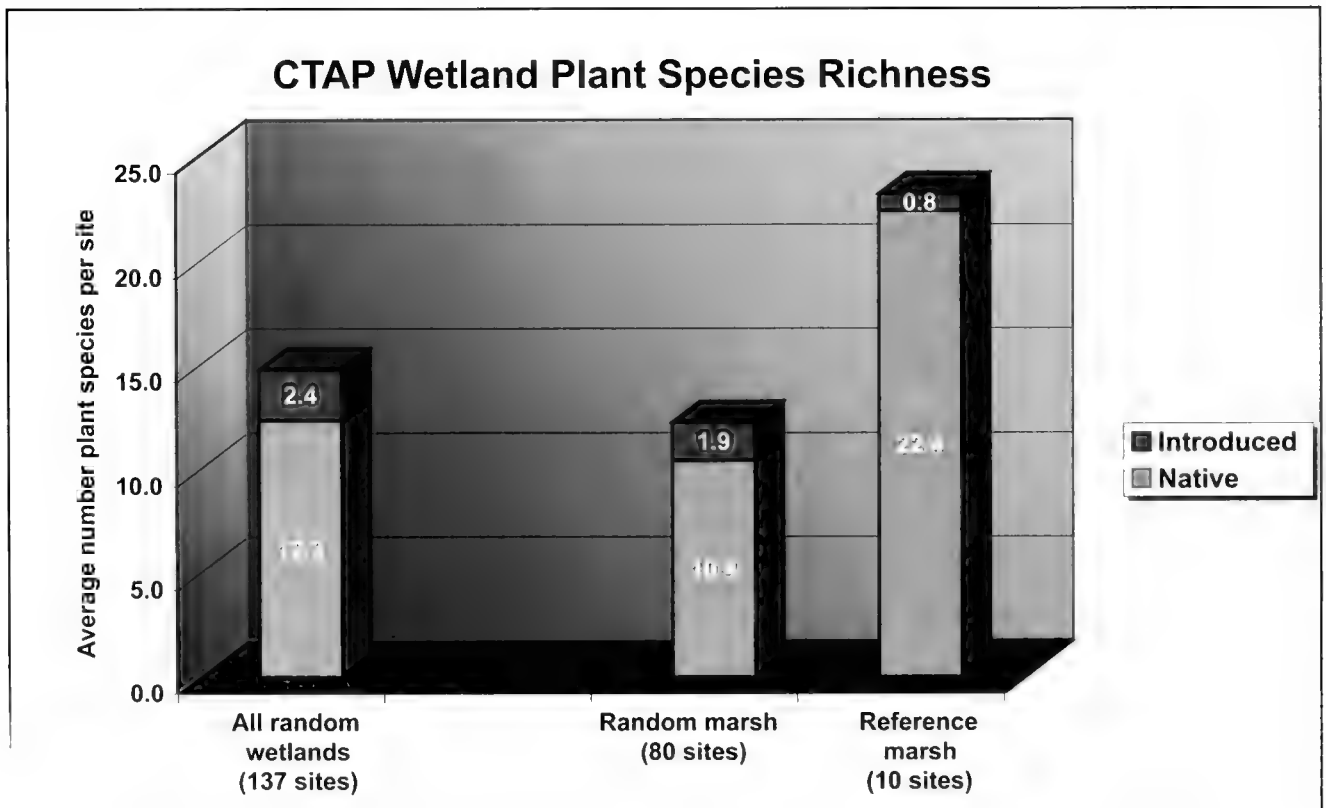


Figure 9. Average number of plant species per wetland site in random and reference site community types.

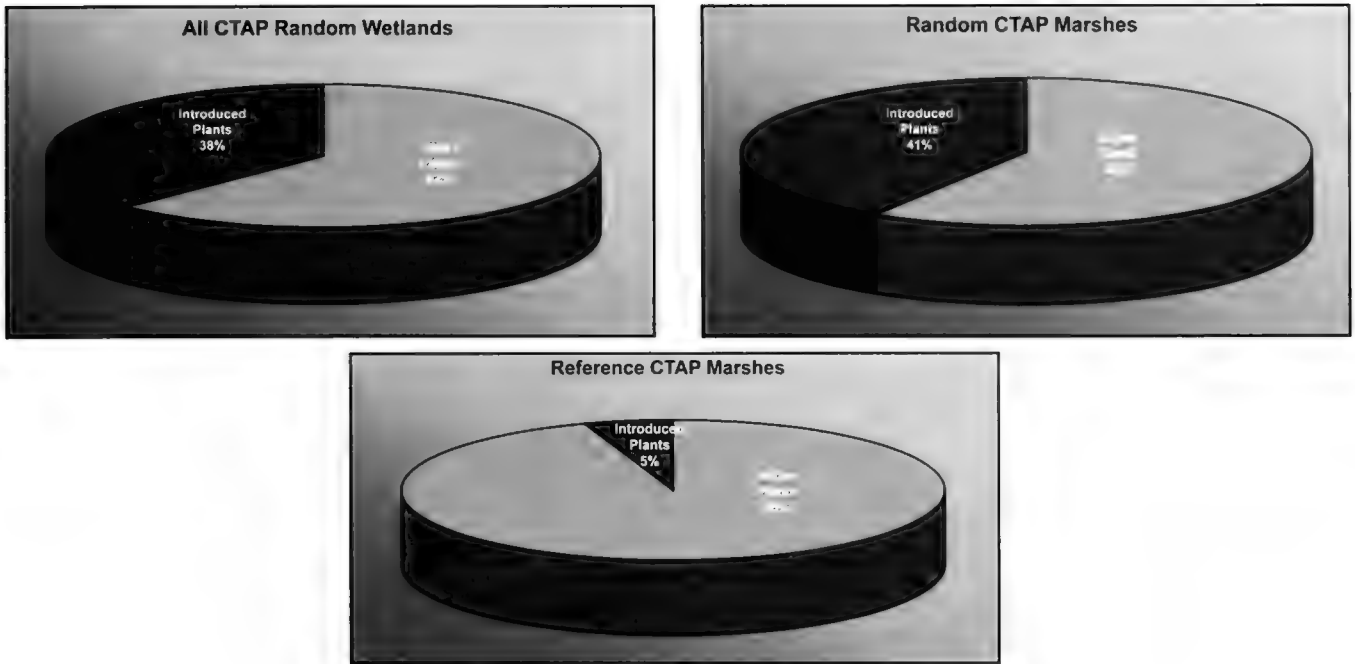


Figure 10. Proportion of native and introduced plant species cover in the ground layer of wetlands sites.

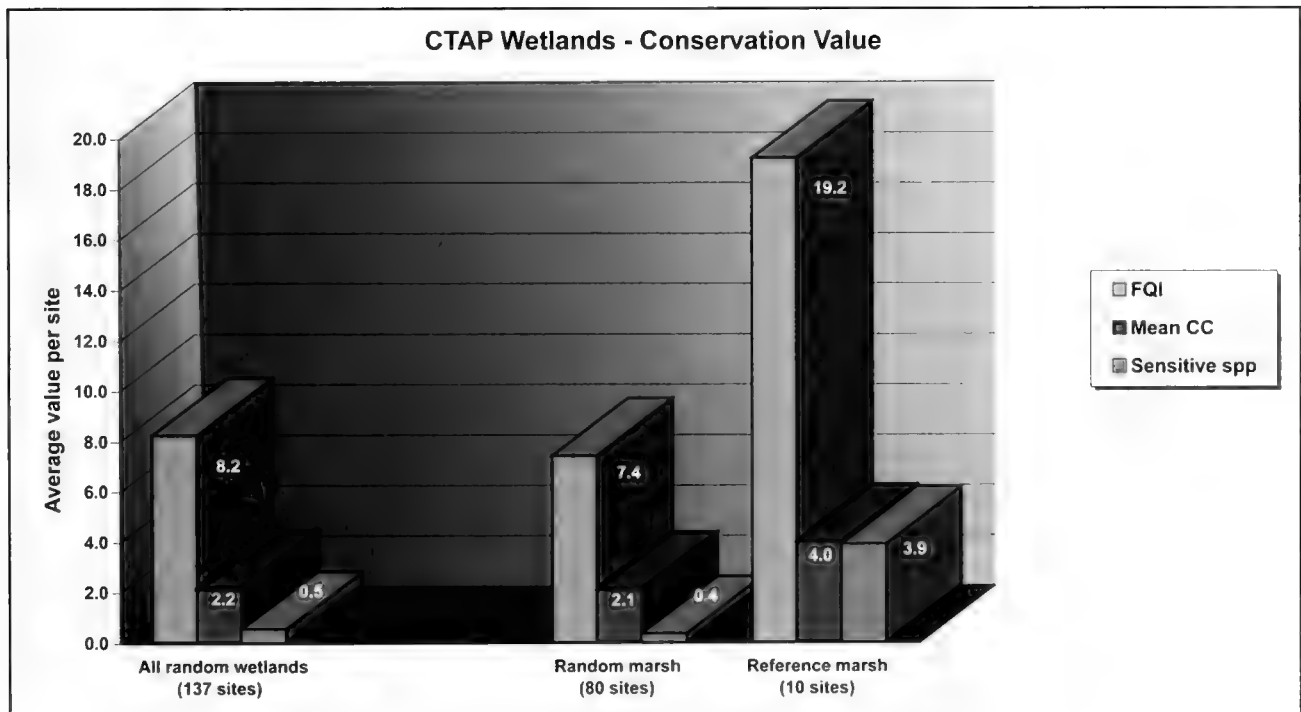


Figure 11. Average Floristic Quality Index, Mean Coefficient of Conservatism, and number of sensitive plant species per wetland site in CTAP random and reference sites.

reed canary grass and common reed grass. Many of these introduced species have formed monocultural stands, resulting in greatly reduced plant diversity. In the case of birds, reference sites had greater species diversity than the randomly selected and additional sites (Fig. 12). Also, as patch size increases more bird species can be found,

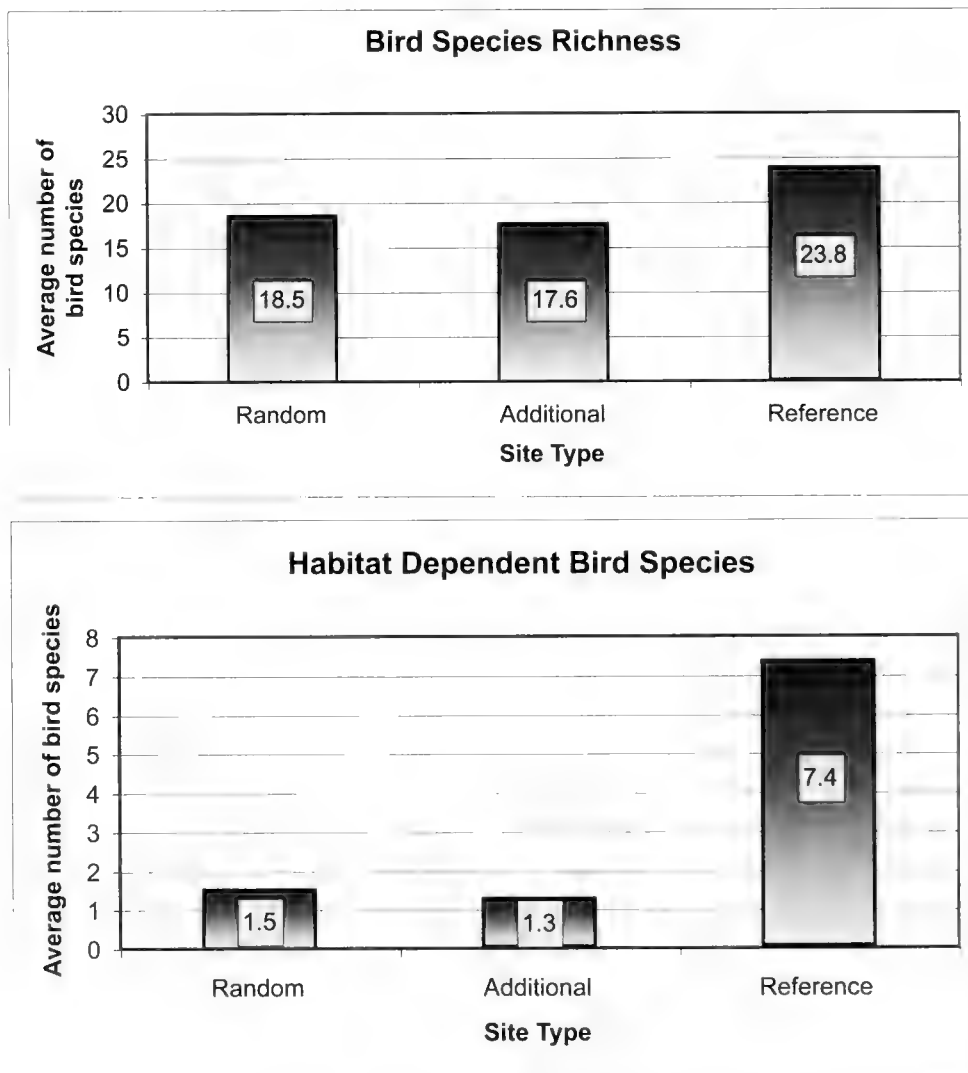
including habitat and area dependent species. This latter result is interesting, as wetland bird species have not been shown to exhibit area dependency (i.e., their habitat must be a minimum size for them to nest, feed, and reproduce) (Fig. 13).

Table 5. Total number of CTAP wetland sites where sensitive plant species, threatened and endangered plant species, and introduced plant species were sampled. Also included is the number of sites where native and introduced species were dominant<sup>1</sup> in the ground layer.

CTAP random wetland sites			CTAP reference wetland sites		
Criteria	# sites	% of total	Criteria	# sites	% of total
at least one sensitive species <sup>2</sup>	41	29.9%	at least one sensitive species	8	80.0%
at least one T & E species	0	0.0%	at least one T & E species	2	20.0%
at least one introduced species	119	86.9%	at least one introduced species	7	70.0%
Ground layer			Ground layer		
dominated by native species	88	64.2%	dominated by native species	9	90.0%
dominated by introduced species	49	35.8%	dominated by introduced species	1	10.0%

<sup>1</sup>Dominance was determined by the species with the highest calculated importance value at each site.

<sup>2</sup>Sensitive species are plant species that are highly sensitive to human habitat disturbance. They have a Coefficient of Conservatism value of >7.



Figures 12. The values shown are the average number of bird species for all sites in the state for the wetland site type. The reference sites are generally of higher habitat quality for breeding wetland birds than the random and additional sites.



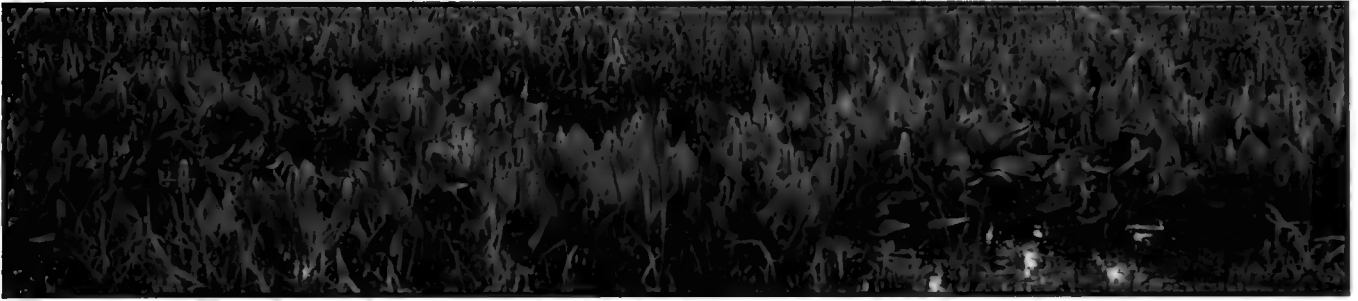
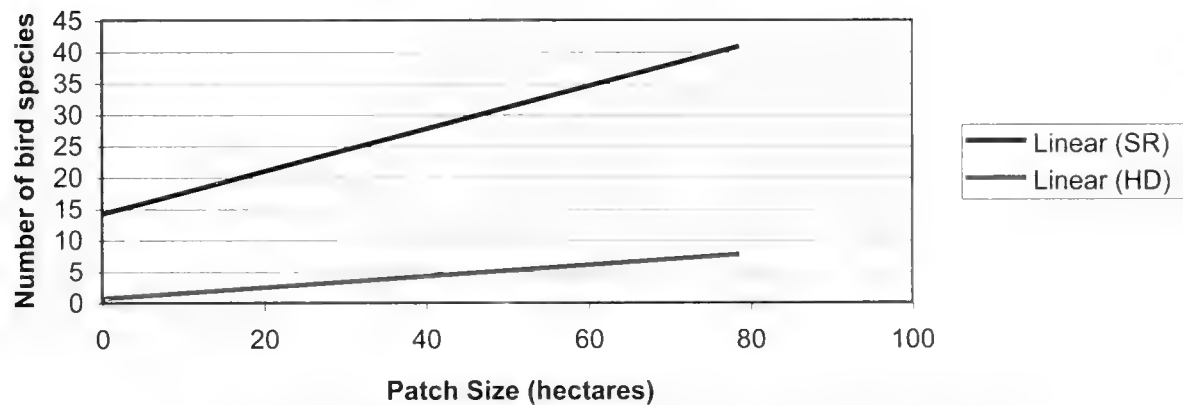


Figure 13. Wetland patch size vs species richness (SR) and habitat dependant(HD) bird species. Wetland bird species have not been shown to exhibit area dependency. What may be more important to these species is habitat quality relative to wetland vegetation and water level throughout the breeding season. However, with increasing patch size, the number of overall wetland species, and both the SR and the numbers of HD species increases. This may be due to larger wetlands in Illinois being of higher quality, more species may be able to utilize them, or larger sites may just be more attractive to many species.

### Wetland Patch Size vs SR and HD



The state threatened Common Moorhen breeds in marshes and marshy pond edges.

# Grasslands



Dickcissel



prairie cicada



butterflyweed

Tallgrass prairie was once the dominant habitat type in Illinois covering 63% of the state (Fig. 14). Over the past 150 years, prairie has been converted to cropland because of its immense soil fertility. Over 99.9% of our original prairie is now gone, meaning that only 1,050 hectares remain intact (Figs. 3 and 14). Similar amount of prairie losses have taken place across the midwestern U.S. Remnant patches of prairie are now so isolated from each other that they function as completely unconnected islands of habitat. Additionally, the fires and large grazing mammals which used to sustain prairies by keeping them open have been eliminated from the landscape; meaning that neglected patches today become overgrown thickets of impenetrable woody vegetation. With the loss of this habitat, entire groups of animals associated with it have suffered similar declines or elimination (e.g., grassland birds and bison). Simply put, this is the most human-impacted habitat in Illinois, if not the most impacted ecosystem type in the world.

Nonetheless, because Illinois' tallgrass prairie has the highest plant species density of any grassland on record—a healthy 5-acre remnant typically harbors more than 100 native plant species—even small patches can be large repositories for biological diversity and are extremely valuable.

To characterize and monitor the entire range of remaining Illinois' grasslands, CTAP randomly selected 128 (125 in the case of birds\*) grasslands and surveyed their plants and birds. In addition to sampling these "average" grasslands, CTAP also sampled 11 minimally disturbed prairie remnants for plants and 10 large grasslands for birds. These grasslands serve as biological references by which to compare randomly selected, average Illinois grasslands to.

Overall, results show that reference sites had greater plant and bird diversity than the randomly selected sites. In the case of plants, reference sites had twice the number of native species (Fig. 15) and five times the FQI values than randomly selected sites (Fig. 16). In addition, reference sites had eight times more sensitive species than randomly selected sites (Figures 16; Table 6). It should be noted that although both reference and randomly selected sites had introduced species, none of the reference sites were dominated by introduced species compared to the overwhelming majority of randomly selected sites (Figs. 16 and 17, Table 6). These results are not surprising as most of Illinois grasslands are pastures, hayfields, or roadsides planted

\* CTAP biologists visit the same grassland for plant, insect, and bird data. In some cases due to unforeseeable circumstances at a site only one kind of datum was collected. This is the reason for the discrepancy between the number of plants and bird sites.

with European forage grasses. In the case of birds, reference sites had greater species diversity than the randomly selected sites (Fig. 18). As patch size increases more bird species are found, including habitat and area dependent species (Fig. 19). These results are not surprising either,

since many studies have shown that large tracts of grasslands will sustain more grassland bird species.

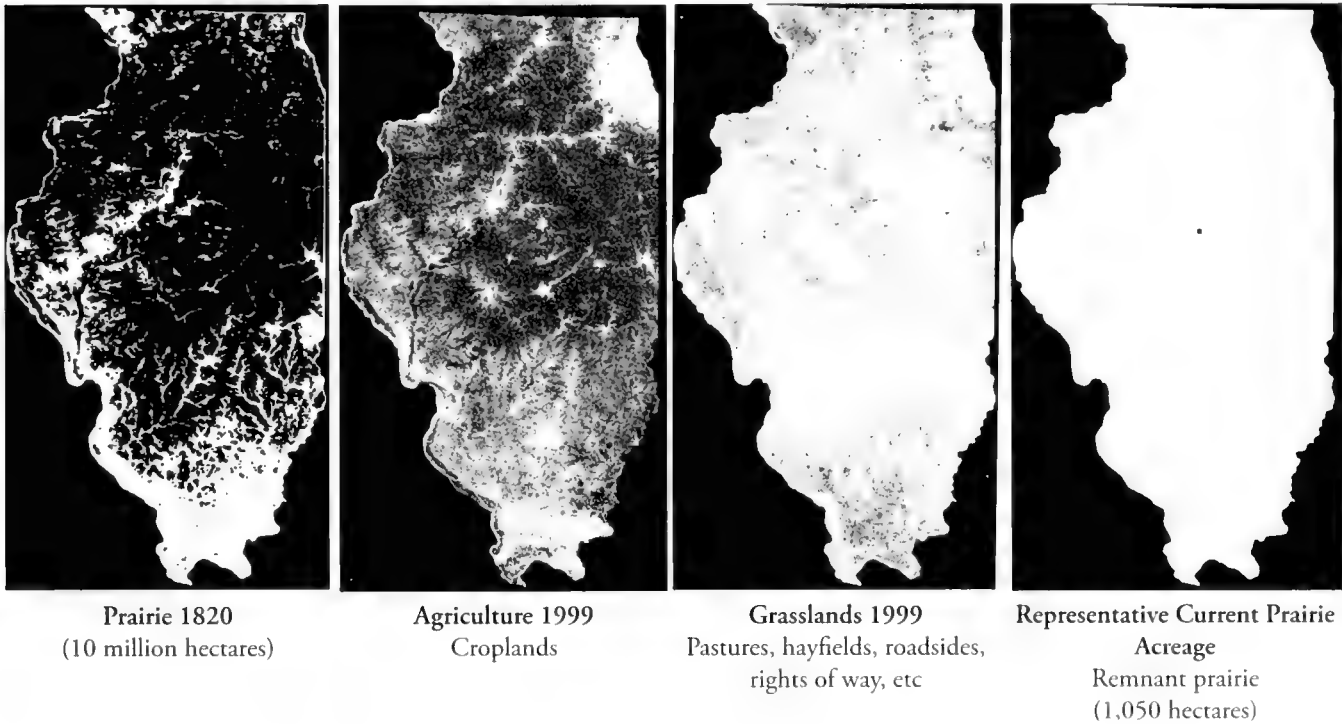


Figure 14. Changes in the Illinois landscape.

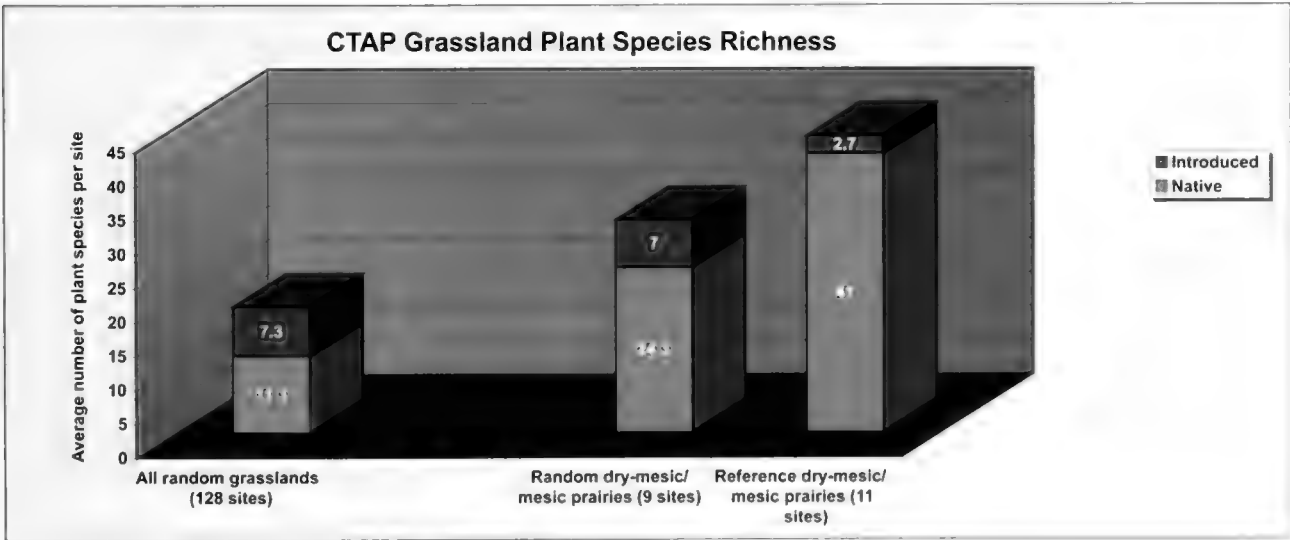


Figure 15. Average number of plant species per grassland site in random and reference site community types.



Typical reference (A) and randomly chosen (B) prairies monitored by CTAP biologists. Prairies or prairie-grasslands are vegetated areas made up of grasses and non woody plants called forbs (or herbs). Prairie was once Illinois' most com-

mon vegetation type. A shows a high quality mesic prairie with a high diversity of grasses and forbs. B shows a grassland randomly selected by CTAP that is dominated by invasive exotic plants such as smooth brome and weeds.

Figure 16. Average Floristic Quality Index, Mean Coefficient of Conservatism, and number of sensitive plant species per grassland site in CTAP random and reference sites.

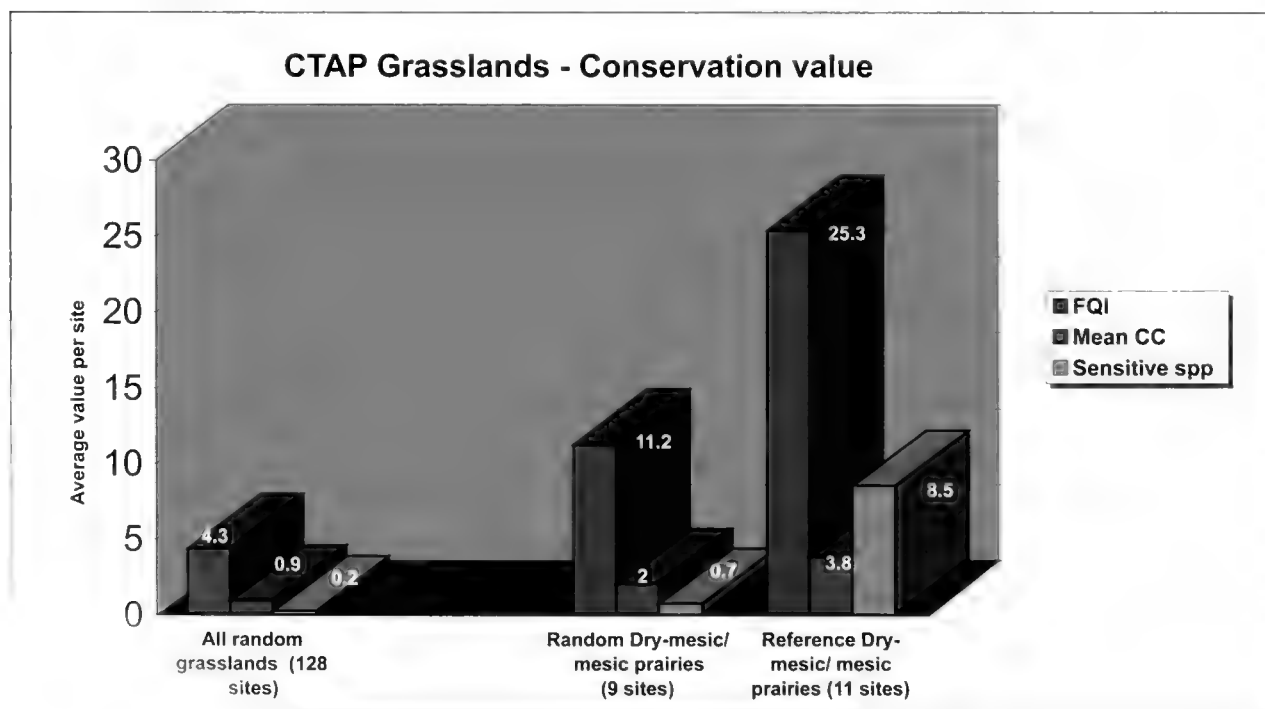


Table 6. Total number of CTAP grassland sites where sensitive plant species, threatened and endangered plant species, and introduced plant species were sampled. Also included is the number of sites where native and introduced species were dominant<sup>1</sup> in the ground layer

CTAP random grassland sites			CTAP reference grassland sites		
Criteria	# sites	% of total	Criteria	# sites	% of total
at least one sensitive species <sup>2</sup>	16	12.5%	at least one sensitive species	11	100.0%
at least one T & E species	1	0.8%	at least one T & E species	1	9.1%
at least one introduced species	128	100.0%	at least one introduced species	11	100.0%
Ground layer			Ground layer		
dominated by native species	18	14.1%	dominated by native species	11	100.0%
dominated by introduced species	110	85.9%	dominated by introduced species	0	0.0%

<sup>1</sup>Dominance was determined by the species with the highest calculated importance value at each site.

<sup>2</sup>Sensitive species are plant species that are highly sensitive to human habitat disturbance. They have a Coefficient of Conservatism value of >7.

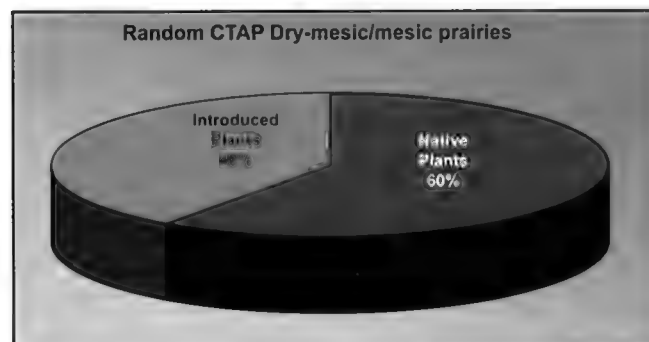
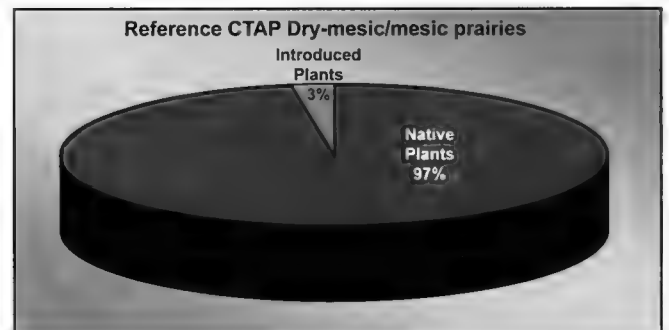
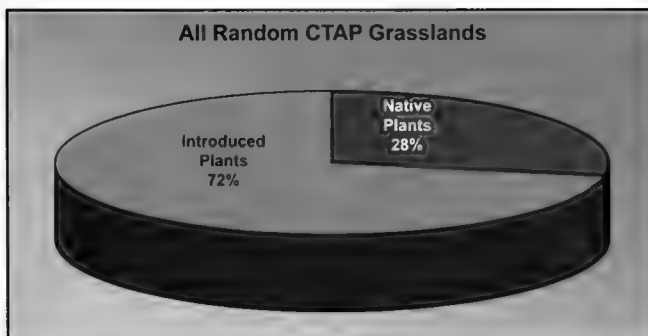


Figure 17. Proportion of native and introduced plant species cover in the ground layer of grassland sites.



Figure 18. The values shown are the average number of bird species for all sites in the state for all the grassland sites monitored within the three site types. The reference sites support significantly more species overall, Habitat Dependent and Area Dependent species are also more common at reference sites than they are at either the random or additional sites.

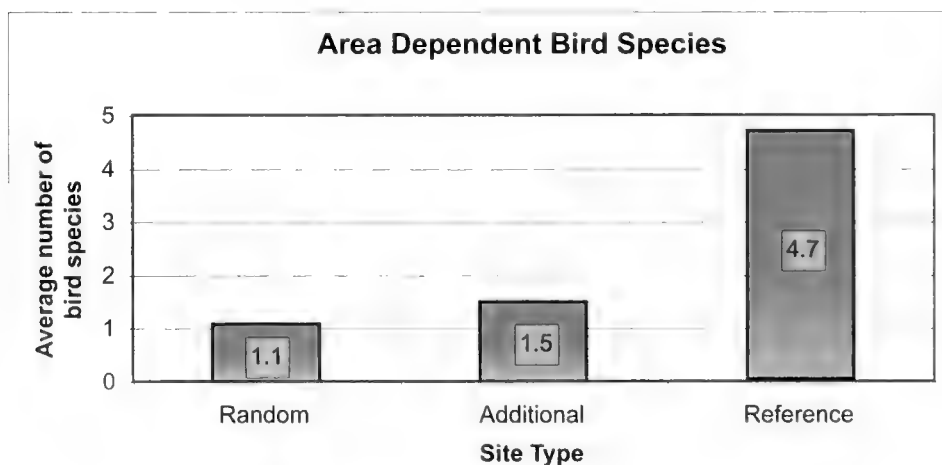
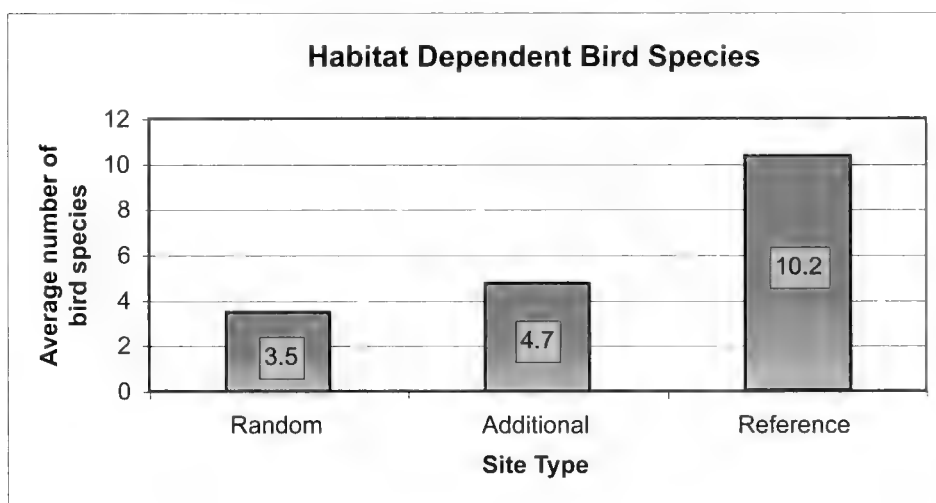
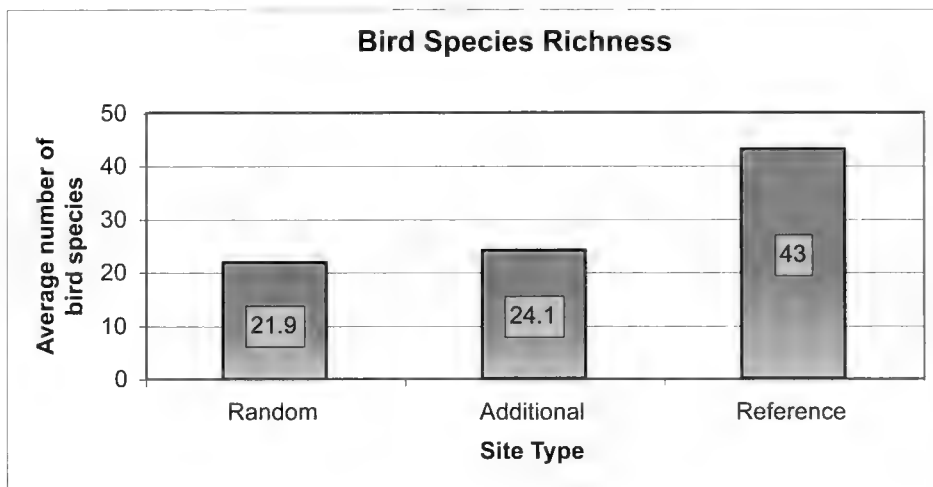
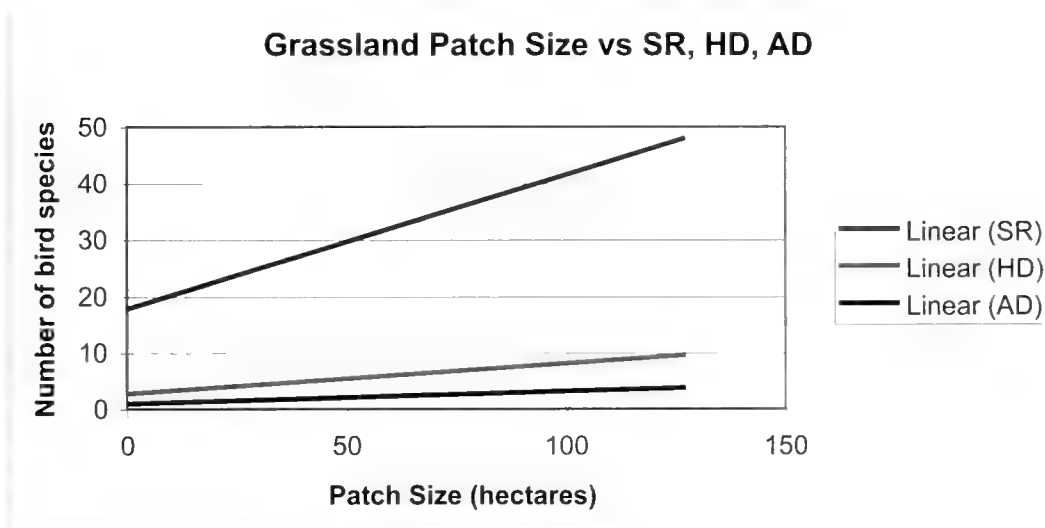


Figure 19. Grassland patch size versus species richness (SR) of birds, habitat dependant bird species (HD), and area dependant bird species (AD). Patch size is the cumulative area surrounding all census points within a site. The area varies among sites depending on the number of points surveyed. In general, as patch size increases so does species richness, the number of HD species, and the number of AD species.



The Upland Sandpiper is a grassland bird that is endangered in the state of Illinois.

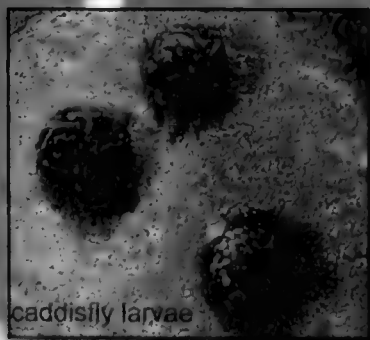
# Streams



stonefly



mayfly nymph



caddisfly larvae

The rivers and streams of Illinois travel approximately 87,000 miles across our landscape. Before the arrival of European settlers, most Illinois streams had meandering courses, natural vegetation, and associated rich wetlands. Since then, agriculture and development have promoted draining of wetlands, made streams more cloudy, and straightened (channelized) and levied stream channels. While these stream “improvements” have grown a vibrant economy, they have done so at the expense of many aquatic species, including freshwater mussels, environmentally sensitive aquatic insects, and fish. The ability of Illinoisans to recreate in and to obtain drinking water from the state’s streams has also declined.

## *Statewide Stream Quality\**

CTAP’s random sampling design and large number of sites (149 sites, Fig. 1) allows for powerful statements to be made about stream quality across the state and in various regions. CTAP assesses streams of all sizes and qualities in proportion to their occurrence across the landscape. Since much of the state has been dramatically altered, the streams also appear heavily altered. Table 8 provides a brief explanation of the environmental indicators used by CTAP to assess stream condition.

## *Results of Statewide Monitoring*

- EPT taxa richness was heavily affected by channelization. Streams with meandering channels had 40% greater richness than did channelized streams (Fig. 20).
- The effect of channelization on EPT remained constant over all stream sizes. (Fig. 21).
- HBI (Hilsenhoff Biotic Index) did not vary appreciably across the state, probably as a result of the historical loss of intolerant species.
- HQI (Habitat Quality Index) was heavily affected by channelization, with meandering streams scoring significantly lower than channelized streams. Habitat across the state is relatively poor.
- OQI (Overall Quality Index) values were much higher for meandering streams than for channelized ones. These values were much higher for larger streams, implying that larger streams, which are less likely to be channelized, have better stream health.

\* Complete report can be found in Spring 2004 Number 379 *INHS Reports*.

Table 8. CTAP indicators of stream health.

EPT Taxa Richness	Number of aquatic insect kinds in the orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). These are food for fish and adult forms provide important links between aquatic and land food webs. The number increases with increasing stream health.
Hilsenhoff Biotic Index	HBI is an average of the pollution tolerance of the EPT species found in the stream. It ranges from 0–10, with low numbers indicating intolerance of pollution.
Habitat Quality Index	HQI provides a numerical score of the ability of the habitat to support aquatic organisms. Streams that have meandering channels, variation in current speed and depth, and natural streamside vegetation often support more complete fish and invertebrate communities, and are better for human recreation and drinking water.
Overall Quality Index	OQI is a number that combines all three of the above. It is a simpler number to discuss than the three indices separately.

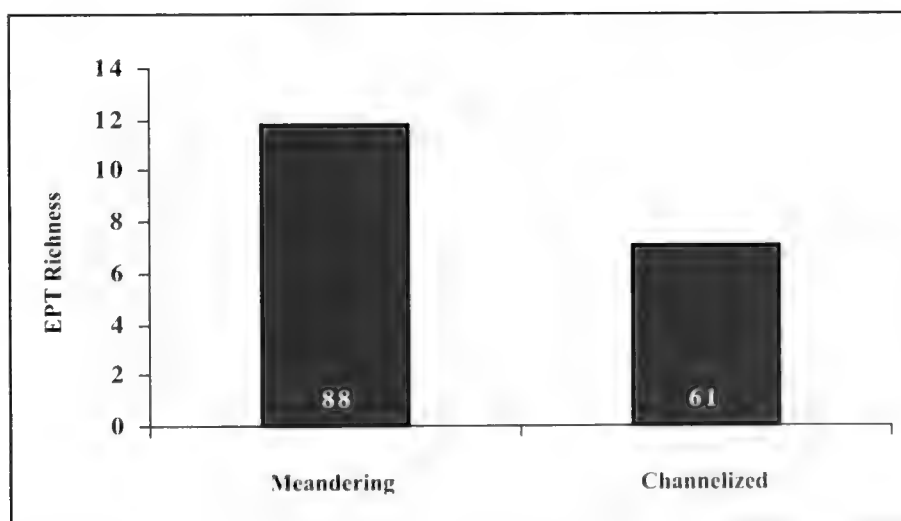
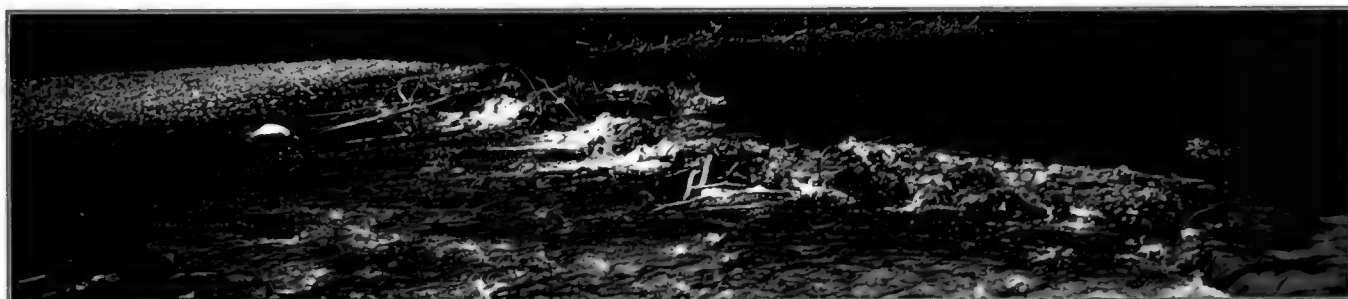


Figure 20. EPT taxa richness for meandering and channelized streams. Numbers in bars indicate sample size.

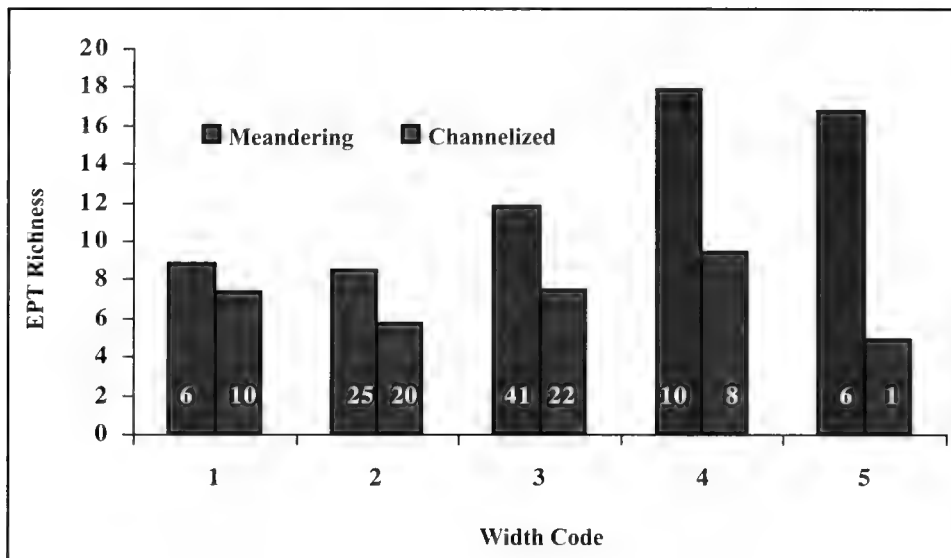


Figure 21. EPT taxa richness for five stream width codes (increasing number = increasing stream width). Numbers in bars indicate sample size.

- The distribution of OQI values shows that the vast majority of streams are of poor-to-fair quality. Only 15% of streams can be considered in good-to-excellent quality (Fig. 22).

#### *Regional Reference Streams\**

CTAP's randomized sampling approach finds very few high-quality streams—they are just too rare across the landscape—making comparisons to the best streams dif-

\* Complete report can be found in Spring 2006 Number 387 *INHS Reports*.

ficult. A second approach, additional sampling of high-quality streams within a region, tells us just how far off a poor stream is from an idealized "reference stream." The Grand Prairie Natural Division (Fig. 23) is the largest and most highly modified natural division in the state. Reference streams in this region are characterized by low human population, meandering channels, and a wide native vegetation zone (See photo A in sidebar on page 25). Channelized streams in the division appear as in photo B. CTAP recently completed characterization of 17 high-quality Grand Prairie streams and has rated its randomly chosen streams using the reference data.

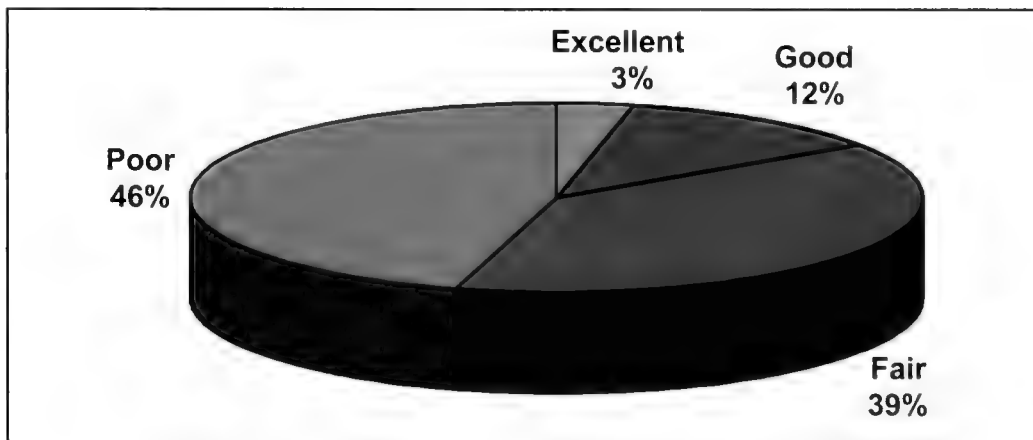


Figure 22. Summary of qualitative stream ratings based on overall quality for 149 streams.



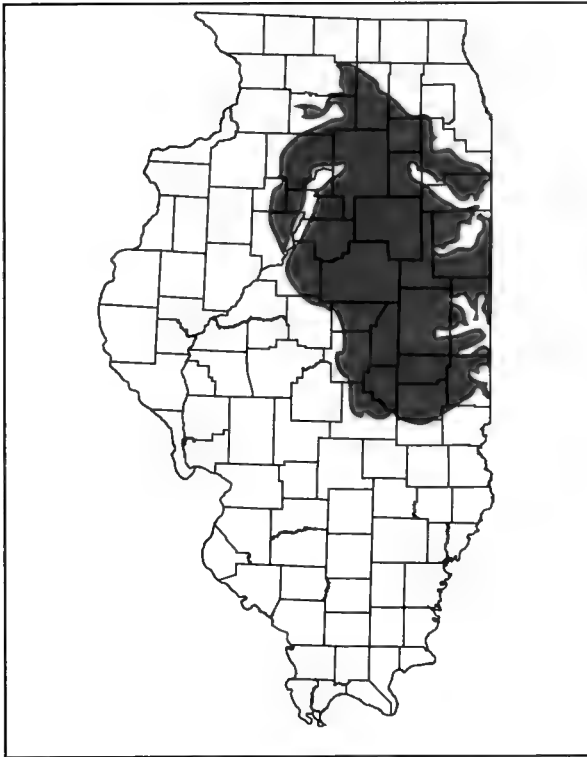


Figure 23. Map of Grand Prairie Natural Division in Illinois.

#### Results for the Grand Prairie Section

- EPT richness was higher in reference streams than in randomly chosen channelized or meandering streams (Fig. 24). Stream size had less of an influence on EPT richness, with no significant differences across small and large reference streams, but significant differences across large and small randomized streams.
- HBI had lower (better) average scores in reference streams, but the difference was not significant.
- HQI was lowest among channelized, randomly selected streams. There was no difference between larger, meandering, randomly chosen and reference streams.
- OQI shows that the vast majority of streams in the Grand Prairie were in Poor and Fair condition (Fig. 25). Less than 22% of streams in the region can be classified as of Excellent or Good quality.



Typical reference (A) and randomly chosen (B) streams in the Grand Prairie. Reference streams in this region are characterized by low human population, meandering channels,

and a wide native vegetation zone (A). Channelized streams in the division appear as in B.

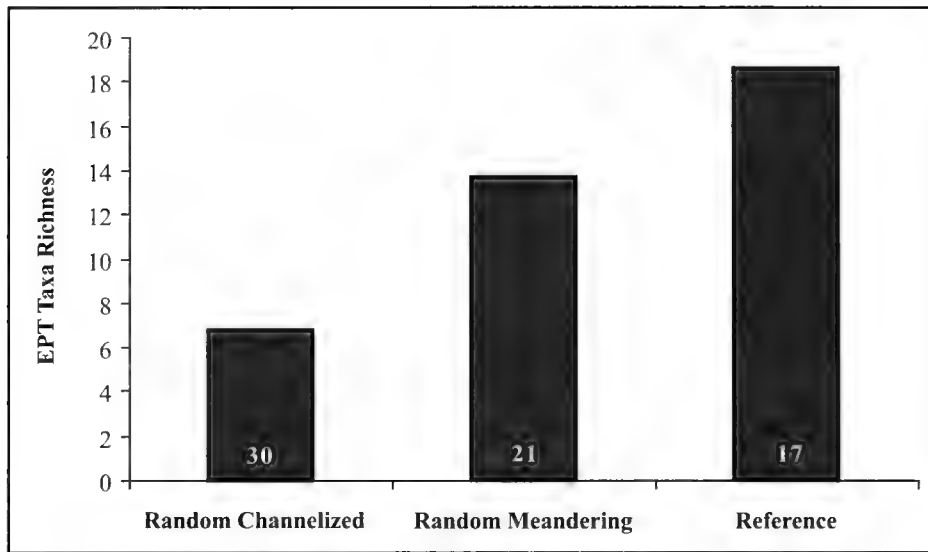


Figure 24. EPT taxa richness of reference and randomly chosen streams of two channel types: straightened and meandering. Numbers in bars indicate sample size.

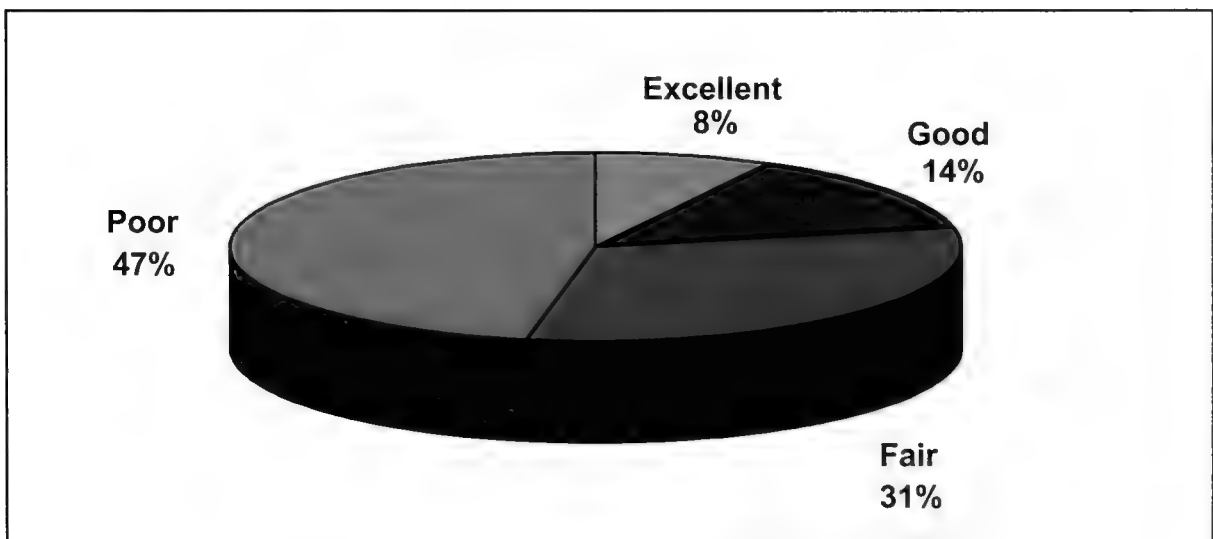


Figure 25. Distribution of overall quality for 51 randomly chosen streams in the Grand Prairie.

## Summary

During the first five-year cycle (1997–2001) of CTAP we have gained considerable knowledge about the current conditions of Illinois habitats. When compared to reference sites, the average forest, wetland, grassland, and stream has lower species diversity and, therefore, support fewer plants, birds, and aquatic insects. This overall finding is not surprising considering changes to the Illinois landscape over the past century. Habitat modifications such as fragmentation and the presence of introduced species have altered natural communities and species



Immature stages of stoneflies are sensitive to stream quality.

diversity in these habitats. Habitat fragmentation has had a negative impact on bird species, meaning that the smaller a tract of forest, wetland, or grassland, the less attractive it will be for many bird species that depend on that habitat. Most of the CTAP forests, both random and reference, are dominated in the ground cover by native species, with the random forests showing a slightly greater species diversity than the reference sites. Most of the random CTAP forests have experienced some type of disturbance and are in various stages of growth following land use activities such as selective timbering, grazing, and natural disturbances such as blow downs, tornadoes, or even flooding. Forests with a more recent history of disturbance tend to be more open and have habitats for a wide variety of plants, ranging from those that are very shade tolerant to those that prefer a lot of sun (pioneer species). As a result, younger or earlier successional forests will often have a greater number of species in the ground cover than older growth forests. The CTAP

reference forests are older growth and historically less disturbed sites than those of the randomly selected forests. Although these forests showed lower species diversity in the ground cover, they tended to have a greater number of more conservative and sensitive species. This resulted in a slightly higher quality assemblage of plant species overall for the reference sites. In the case of wetlands and grasslands, introduced plant species have predominant abundance, mostly the result of agricultural practices. In grasslands this is mainly due to planting of introduced grass species for a variety of areas such as along roadsides, in agricultural waterways, and in pasture mixes. Wetlands on the other hand are more often invaded by introduced species, although the planting of species such as reed canary grass is still practiced for some wet pasture areas. Finally, for streams across Illinois and within the Grand Prairie, drainage alterations and modifications associated with agricultural practices are the single most important reason for poor stream health.

Although this report has presented a somewhat bleak picture of current conditions for the average forest, wetland, grassland, and stream in Illinois when compared to reference sites, these results should serve as a mechanism



Blue water iris can be found in wetlands and at the edges of lakes and ponds in Illinois.

to launch a greater effort to manage and restore these habitats to the statewide condition of reference sites. This may be a high goal to achieve but not an unrealistic one. Our recommendations are to:

- promote more communication and coordination among various natural resource agencies to provide a holistic approach to land management across Illinois. For example, in the case of forests, where large areas of habitat already exist, efforts to reduce poor logging methods (i.e., clear cutting or over harvesting of trees) and strategic reforestation could easily increase the continuity of forest tracts and reduce canopy openings, and therefore significantly reduce fragmentation. This would provide additional nesting habitat to our most vulnerable birds, the habitat and area dependent species;
- apply more resources toward educating the public concerning vegetation management in forests and the impact of exotic plant species;
- stop the further drainage of isolated wetlands, re-establishing natural hydrological regimes, and

reduce introduced species, that often form monocultures, to enhance both plant and bird species;

- facilitate the development of large grassland areas through various conservation programs and reduce invasion of trees and shrubs into these areas; this would provide tremendous benefit to area-dependent birds species;
- protect and restore the areas that harbor our last remnants of prairie. If we are to preserve the diversity of plants, insects, and other animals of prairies we must preserve even the smallest of these areas. Development, destruction, and invasion by exotic species provide the main threats to prairies;
- prohibit new channelization and reduce stream maintenance activities to improve stream habitat in the Grand Prairie Division and across Illinois;
- finally, create wetlands to dampen flood events and add habitat structures (even in channelized streams) to provide refuge from the scouring effects of floods.



A high-quality prairie bursts with color.

The Critical Trends Assessment Program will continue collecting data to document the progress of changes in the Illinois landscape and will continue reporting on them. For additional information about CTAP go to <http://ctap.inhs.uiuc.edu/>.

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February 2007



All CTAP and Ecosystems Program documents are available from the DNR Clearinghouse at (217) 782-7498 or TTY (217) 782-9175. Selected publications are also available on the World Wide Web at:

<http://ctap.inhs.uiuc.edu>  
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For more information about CTAP, call (217) 782-7940 or e-mail at [ctap2@dnrmail.state.il.us](mailto:ctap2@dnrmail.state.il.us); for information on the Ecosystems Program call (217) 782-7940 or e-mail at [ecoprogram@dnrmail.state.il.us](mailto:ecoprogram@dnrmail.state.il.us).

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